

OBSERVATIONS ON THE CERATOPOGONINE MIDGES OF THE GOLD COAST WITH DESCRIPTIONS OF NEW SPECIES

PART IV

BY

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(Received for publication 7 April, 1921)

Genus *DASYHELEA*, Kieff.

Ceratopogon, Wtz. (*pro parte*) (*nec*. Mg. Edws.). *Linnea Entomologicae*. Vol. VI, 1852.

Culicoides, Kieff. et auct. (*pro parte*) (*nec*. Latr.).

Dasyhelea, Kieff. *Bull. Soc. Hist. Nat. Med.* Vol. III, 1911.

Prokempia, Kieff. *Rec. Ind. Mus.* Vol. IX, 1913.

Pseudoculicoides, Mall. *Bull. Ill. Sta. Lab. Nat. Hist.* Vol. X, 1915.

Dasybelia, Brunetti. *Rec. Ind. Mus.* Vol. XVII, 1920.

This genus is closely related to *Culicoides*, Latr. It was erected by Kieffer in 1911 for the Indian species *D. halophila*, and subsequently (1913) divided by him into three sub-genera—*Dasyhelea* (*sens. stric.*), *Prokempia* and *Kempia*—according to the nature of the wing hairs and the empodium. Later (1917) the last two sub-genera were given generic rank by this author, who then associated *Prokempia* with *Dasyhelea* but removed *Kempia* to the *Atrichopogon* group. Still later (1919) Kieffer again placed *Prokempia* as a sub-genus of *Dasyhelea*. *Prokempia* apparently differs from *Dasyhelea* only in the absence or relative scarcity of the longer wing-hairs, and was separated for this reason; but although the density of arrangement of these hairs is much more uniform in *Dasyhelea* than in *Culicoides*, this character cannot, in our opinion, be considered of more than specific value.

Malloch, in 1915, founded the genus *Pseudoculicoides* for *Ceratopogon mutabilis*, Coq., especially distinguishing it from *Culicoides* by the absence of thoracic cavities and the antennal structure of the male. The description and figures of this species given by Malloch indicate that it is a typical *Dasyhelea*, and Kieffer (1919) accordingly placed *Pseudoculicoides* as a synonym of the latter. Malloch, however, made no reference to the eyes—the hairiness of which was given by Kieffer as one of the diagnostic characters of the genus—either in his generic definition or specific description; but Mr. F. W. Edwards, in a private communication, informs us that the eyes of specimens (named by Malloch) of *C. mutabilis* in the British Museum collection are shortly but distinctly hairy, and therefore Kieffer's decision in regard to this question must be accepted.

EXTERNAL MORPHOLOGY.

The detailed anatomy of *Dasyhelea* differs from that of *Culicoides* (see Part II of this study, 1920) as follows:—

ADULTS. *Head*. Eyes in both sexes densely clothed with microscopic hairs.

Mouth-parts (fig. 1). Proboscis somewhat shorter than that



FIG. 1. Mouth parts of *D. pallidibalter* (♀): a—labrum; b—maxilla; c—mandible; d—hypopharynx. ($\times 490$ circa.)

of *Culicoides*, the component organs, except the labium, differently formed and apparently not adapted for piercing in either sex. The labrum is strongly chitinated, broad at the base gradually tapering

to a rounded, hairy apex. The hypopharynx is similar in shape to the labrum, but tapers more rapidly and ends in a pointed apex; the distal fourth bears numerous hair-like marginal processes. The mandibles and maxillae are poorly developed and devoid of teeth; the former are closely applied to (and not easily separated from) the labrum and hypopharynx, and are enclosed in membranous sheaths which extend considerably beyond their extremities; the maxillae are rudimentary and are reduced to small, thinly chitinated, blade-like structures. The palpi in both sexes appear to be composed of four segments owing to the first being very rudimentary and often almost indistinguishable; the third segment is usually distinctly longer than the fourth or fifth and is scarcely swollen, with the minute sensory hairs scattered over the inner surface from the base almost to the apex—not concentrated in a relatively deep and sharply defined depression.

The above description of the mouth-parts is based upon dissections of two of the new species (*D. pallidihalter* and *D. flava*) described herein, and of the European *D. obscura*, Wtz. The structure of the various organs is apparently the same in males and females, and, in our opinion, is such that these midges would be incapable of piercing the skin. Malloch (1915), however, states that *D. (Pseudoculicoides) griseus*, Coq., 'was taken biting, on the bank of Sangamon River,' and that *D. cinctus*, Coq., has been 'recorded as biting human beings.' In Accra, specimens of *Dasyhelea* spp. occasionally alighted on the arm, but, so far as observed, they made no attempt to bite; possibly, therefore, the statement regarding *D. griseus* may have been due to a similar occurrence, and may subsequently require modification. At least, until the feeding habits of the midges of this genus have been carefully studied, the above statement must be regarded with reserve.

Antennae: segments of the flagellum in the female shorter and broader than in *Culicoides*, gradually lengthening towards the apex, but with the apical ones not distinctly differentiated from the basal; last four segments (twelve to fifteen) in the male, elongate, the twelfth to fourteenth inclusive cylindrical, binodose,* the whorls of

* The apical node is usually less well-developed than the basal node, and the hairs are shorter and more slender; but there is distinct variation in this respect, and in *D. flava*, sp. n. (see p. 196), the apical whorl is obsolete.

hairs arising from nodal rings situated on the basal and apical thirds of each segment. In both sexes, but more conspicuously in the males, the segments of the flagellum exhibit a tessellated or sculptured appearance, due to the presence of small chitinous plates, from the upper portion of each of which a hair arises; on the basal segments (four to eleven) in both sexes this sculpturing appears to be limited to the proximal portions (*i.e.*, the area below the whorls) of each, where the plates are sharply defined and radially arranged; on the distal segments the plates are arranged as shown in fig. 2.

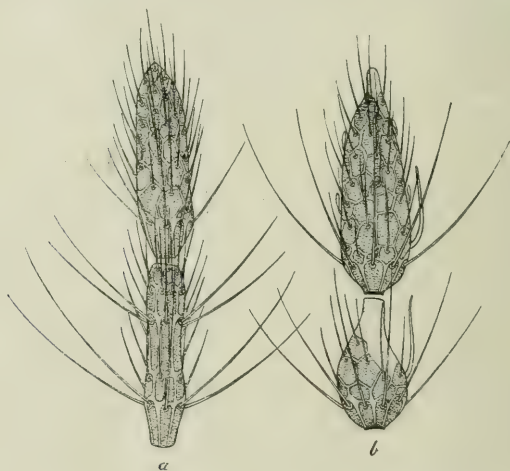


FIG. 2. Terminal segments of antennae of *a*—*D. fusciformis* (♂) and *b*—*D. inconspicua* (♀). ($\times 475$ circa.)

Thorax without anterior or posterior pits or depressions; scutellum with a varying number of strong marginal or sub-marginal bristles and usually a few (one to six) short hairs.

Wings hyaline, unspotted; the venation very similar to that of *Culicoides*, but with the first and third veins less distinctly separated, so that normally only one interspace can be distinguished; in some species these veins appear to be completely fused.

Legs. Tibiae without apical spurs, but the fore and hind pairs with oblique or transverse rows of bristles distally; first tarsal

segments of all legs sub-equal, those of the middle legs not appreciably elongated. Claws small, equal, simple in the female, divided at the tips in the male; in both sexes the inner margin may be somewhat prominent, tooth-like, at the base, and agulate near the middle.

Abdomen. Dorsum covered with minute flattened spines; segments one to seven each with two small, clear, thinly chitinised, rounded areas. Spermatheca (fig. 9, *b-f*) single, heavily or moderately chitinised, usually sub-spherical, the commencement of the duct sometimes chitinised for a considerable distance.

External genitalia of the male. Ninth segment:* tergite, apical lobe-like processes well developed, often projecting posteriorly beyond the tergite and sometimes bearing a median dorsal triangular chitinised plate; sternite not excavated, sometimes produced posteriorly in the middle line (c.f. figs. 10, 11). *Forceps:* side-pieces similar to those of *Culicoides*; claspers simple or divided, if the latter the branches variously formed, dissimilar. *Harpes* with the proximal portions greatly developed, highly chitinised, and in some species connected medially to form an uninterrupted, or almost uninterrupted, transverse bar. The distal portions show varying degrees of development and chitinisation, and in all the species, except one, examined by us, the distal portion—bent sharply and directed posteriorly—of only one harpe is developed, thus causing asymmetry; in the exception referred to (*D. similis*, sp. n.) the distal portions of both harpes appear to be developed, but are fused in the middle line forming a conspicuous median structure. *Aedoeagus* strongly chitinised, usually broad but of variable form.

* In regard to the nomenclature of the hypopygial structures adopted in this and previous studies, Parts II and III (1920-1921), on the Ceratopogonine midges of the Gold Coast, Mr. F. W. Edwards writes us as follows:—'I now think that your harpes are the same structures which de Meijere has called gonapophyses in the Limnobiidae, and I was probably right in homologising them with the parameres of Culicidae. There is one difference, at first sight fundamental, in that in *Culicoides* and Limnobiidae (e.g., *Eriocera*) the structures are dorsal to the aedoeagus, adjoining the tenth sternite (which I consider to be represented by your spicular strip of membrane), whereas in the mosquitoes they are morphologically ventral to the aedoeagus. However, it would seem likely that this is connected with the atrophy of the anal chitinisations in *Culicoides* and the Limnobiidae, the parameres moving dorsally and fusing in the mid-dorsal line in order to replace, in function, the tenth sternite. In other insects the parameres are said to be normally lateral in position, so that it is easy to understand that they might pass either dorsally or ventrally. In any case the important idea to lay hold of is that the parameres form with the basal plate the first (morphologically innermost) ring of the genital tube, the second ring being the mesosome which is more or less invaginated into the first. In *Culicoides* I believe the structure you call the aedoeagus is really the basal plate only, and that there is no mesosome. Properly speaking the term aedoeagus should include in this case also the "harpes." The two small chitinous appendages of the ninth tergite, of course, represent the tenth tergite.'

PUPA. The pupae of *Dasyhelea* much resemble those of *Culicoides*, the chief point of difference being in the reduction of the first and elongation of the second abdominal segments, the shape and structure of the respiratory trumpets and the arrangement of tubercles on the body.

The structure of the trumpets, as shown in the species examined by us, is of especial interest since forms occur which represent transitional stages between the simple type, as exemplified by *Culicoides*, and the complex type as found in at least some species of *Forcipomyia* (e.g., *F. ingrami*, Cart., 1919). Such forms are shown in fig. 3, b-d; the last type figured evidently represents

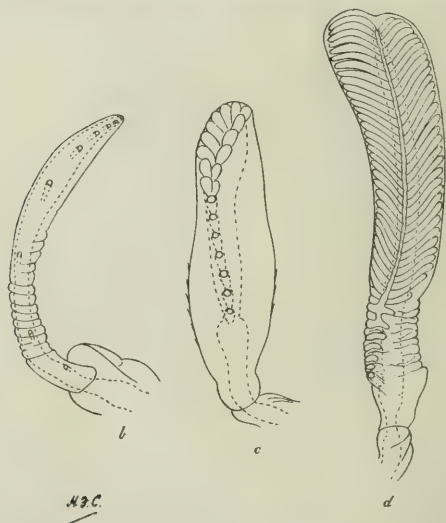


FIG. 3. Pupal trumpets of b—*D. flaviformis*; c—*D. ingrofulsa*; d—*D. fusca*. (b—c \times 360 circa; d \times 220.)

a stage in development immediately preceding that occurring in *Forcipomyia*, for by a simple folding back of the distal leaf-like portion an organ very similar in structure to the trumpet of *F. ingrami* could be produced.

The chief differences in the arrangement of the body tubercles is as follows:—*Cephalothorax*: anterior dorsal tubercles absent, anterior dorso-median tubercles present (as in *Stilobezzia*), dorsal, postero-dorsal, and ventro-median tubercles absent but sometimes represented by minute hairs; the dorsal surface of the thoracic portion is thus entirely devoid of distinct tubercles, but is, on the other hand, usually pigmented or striated in circumscribed areas. *Abdomen*: tubercles flattened and flange-like, the dorsal antero-submarginal tubercles small or rudimentary, one only on each side; the postero-marginal tubercles are situated, as in *Stilobezzia*, near the middle transverse line of each segment, around which they form an almost continuous (interrupted in the middle line of the dorsal and ventral surfaces) band; on segments three to seven they are nine in number, of which the three central ones (ventro-lateral tubercles) are the most highly developed. In some species small, rounded, pigmented areas, arranged in the form of a triangle, are present on both dorsal and ventral surfaces.

The terminal processes are broad and flattened, and are directed dorsally and laterally; at the base of each are two prominent tubercles bearing hairs and spines.

LARVA. The mature larva differs from that of *Culicoides* chiefly in regard to the size and shape of the head, the position of the eyes and in the possession of a small hooked pseudopod at the posterior extremity of the body (fig. 9, g).

The *head* is distinctly larger (almost twice as large as in *Culicoides*) and tapers more strongly towards the apex, being obovate rather than sub-conical; it bears minute hairs only. The eyes are reniform and are situated far forwards, near the anterior third. The mouth-parts are similar in structure to those of *Culicoides*, but, in the three West African species observed, appear to be rather more highly developed in so far as the hypopharynx is larger and more complex, the mandibles are tridentate and the labium is more highly chitinated and more strongly serrated. The *body* is elongate and scantily clothed with very minute hairs; the anal pseudopod is retractile, small and membranous, and bears two dorsal and two ventral groups of small but strongly chitinated, recurved hooks which are directed anteriorly. The anal papillae are short, bifid, with slightly blunted extremities.

SPECIFIC DESCRIPTIONS.

Dasyhelea pallidihalter, sp. n.

MEASUREMENTS.						Female.	Male.
Length of body*	...	...	...	...	...	1.3 mm.	1.3 mm.
Length of wing	...	...	...	...	...	0.8 mm.	0.8 mm.
Greatest breadth of wing	...	...	...	...	...	0.3 mm.	0.3 mm.

Head dark brown, clothed with dark hairs. Eyes narrowly separate in both sexes. Proboscis and palpi brown, the latter with the third segment uniformly and slightly swollen and almost twice as long as the fifth; the second, fourth and fifth short, sub-equal. *Antennae* dark brown with dark brown hairs; in the female the segments of the flagellum are sub-spherical at the base, gradually lengthening, becoming oval, towards the apex, the fourth to eleventh each bearing a pair of large, strong, bluntly rounded spines; in the male, segments four to eleven are sub-spherical to ovoid in shape, the length from two-thirds to one and one-third times the greatest breadth, segments twelve to fifteen are elongate, about three times as long as wide, the last broader and pointed distally, the twelfth to fourteenth sub-cylindrical, each distinctly binodose. *Thorax* dark brown with small yellowish-brown areas in the humeral angles and over the roots of the wings. Scutellum dark brown, becoming brownish-yellow centrally, bearing four centro-marginal and two lateral bristles, and a median transverse row of about six short hairs. Post-scutellum and pleurae dark brown. *Wings* in the female well clothed with decumbent hairs which extend almost to the base between the fourth and fifth veins and are numerous in the anal angle and fork of the fifth vein. Costa and first and third longitudinal veins not extending to the middle of the anterior border, terminating above or slightly beyond the bifurcation of the fifth vein and enclosing a small but distinct cell or interspace; in the male less hairy (no hairs at the base of the wing, and very few, if any, in the anal angle or fork of the fifth vein), the costa terminating slightly before the bifurcation of the fifth vein. Halteres white, or almost white. *Legs* uniformly dark brown. Claws in both sexes with the inner margin at the base somewhat produced, and near the middle with a small, angulate prominence. *Abdomen*: dorsum

* In all cases taken from the anterior margin of the thorax to the tip of the abdomen of specimens mounted in carbolio.

dark brown, sparsely clothed with dark brown hairs, venter rather paler brown. Spermatheca highly chitinised, spherical (diameter 50μ) with a conical posterior extension (length about 20μ) leading to the duct.

HYPOPYGIUM (fig. 4). *Ninth segment*: tergite short and broad, relatively strongly chitinised and sparsely clothed with moderately long, strong hairs, posterior margin straight, produced on each side into a small, rounded, hairy knob, apical lobe-like processes well developed, often extending as a centrally indented membrane considerably beyond the extremity of the tergite; sternite broad,

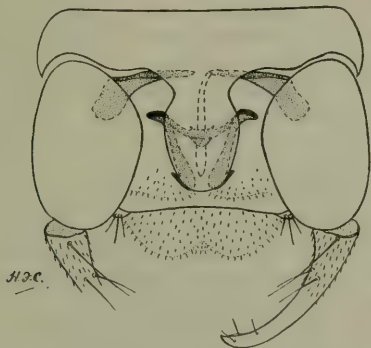


FIG. 4. *D. pallidibalter*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

produced centrally and posteriorly into a relatively large, more or less oval, lobe-like process. *Forceps*: side-pieces well chitinised and with long hairs, as in *Culicoides*; claspers long and slender, rather strongly chitinised, the basal half pubescent with a few strong hairs, the apex pointed, slightly depressed, bearing two or three short, delicate hairs. *Harpes* as shown in fig. 4, the proximal portions very strongly chitinised, the distal portion—only that of the left* harpe is developed—very feebly chitinised, narrow and bent almost at a right angle to the proximal portion. *Aedoeagus* somewhat V-shaped, relatively short, the lateral arms with outwardly directed,

* In this and all subsequent species in which the harpes are not symmetrically developed, the side of the insect from which the distal portion arises is stated. The figures of the hypopygium, however, show the ventral aspect and therefore in them the right side of the insect lies to the left of the reader.

pointed, beak-like, distal processes and connected anteriorly by a slightly curved, centrally thickened chitinous bar.

PUPA. Length 1.9 mm. Integument pale brownish-yellow, not infuscated in any part or heavily shagreened except on the operculum and on the posterior abdominal segments. *Respiratory trumpets* narrow and strongly curved, almost semi-circular; length about 0.3 mm. The trumpets are obliquely and irregularly ringed, the tracheal trunk in each gives off a number of short lateral branches, which lead to small elevations on the surface, and terminates distally in five or six short, blunt processes. *Cephalothorax*: dorsum of thoracic portion not pigmented, smooth except on anterior border, and with a few puckered or striated areas. Anterior marginal tubercle large, shagreened, bearing a short bristle; dorso-lateral tubercle rounded, smooth, bearing two or three small hairs, anterior dorso-median tubercle small, bearing a short hair; ventro-lateral tubercle moderately large, rounded, bearing a short spine and a short hair; ventro-median tubercle represented by two minute hairs. Between the anterior marginal tubercles are two (one dorsal and one ventral) rounded, unarmed median humps. Dorsal tubercles absent, but anteriorly represented by one or two minute hairs. *Abdomen*: integument reticulated and slightly shagreened at the sides and base of each segment, more heavily shagreened on the distal segments, the last entirely shagreened. Tubercles arranged as mentioned on page 183, the antero-submarginal tubercle small armed with a short spine, the dorsal and ventral postero-marginal tubercles apparently unarmed, low, broad and flange-like, the ventro-lateral postero-marginal tubercles larger and conical, the middle bearing a short hair, the others a short spine. Terminal processes broad and flattened, directed dorsally and laterally, each with two posterior tubercles, bearing respectively a hair and a spine.

LARVA. Length about 3 mm. *Head* obovate, convex dorsally, flattened ventrally; length 0.2 mm., greatest breadth 0.12 mm. Hairs scanty, minute. Mental plate crescentic, moderately chitinised, apparently bearing nine teeth on each side, the last large and broadly rounded, the others small, narrowly rounded and closely apposed. Mandibles large, highly chitinised, the distal portion bearing three large teeth on the inner side. Hypopharyngeal sclerite very highly chitinised posteriorly, the posterior portion

armed with three rows of teeth and with a delicate, serrated, fringe-like expansion on each side. *Body* scantily clothed with minute hairs, the last segment with apparently eight pairs of very small hairs near the extremity. Posterior pseudopod (fig. 9, *g*) small, the dorsal groups each consisting of two hooks, the ventral groups each of four hooks.

HABITAT: Nsawam, Gold Coast. Reared from rotting material collected from the base of a banana plant; March to May, 1920.

Dasyhelea fusciscutellata, sp. n.

MEASUREMENTS.	Female.	Male.
Length of body (two specimens)	1.0 mm.	1.1 mm.
Length of wing	0.8 mm.	0.8 mm.
Greatest breadth of wing	0.3 mm.	0.3 mm.

Head dark brown with almost black hairs. Eyes narrowly separate in the female, very narrowly separate in the male. Clypeus, proboscis and palpi brown; third segment of the latter cylindrical, slightly and uniformly swollen, about as long as the fourth and fifth segments together. *Antennae* brown with black hairs and, except on the last five segments, long spines; in the female the segments ovoid and sub-equal in size gradually elongating towards the apex, but the thirteenth and fourteenth segments slightly longer than the eleventh and twelfth, last segment the longest, not produced distally into a stylet; in the male, segments four to eleven spheroidal, gradually becoming narrower and more elongate apically, the last four segments longer, the twelfth and thirteenth sub-equal in length, each slightly longer than the fourteenth, the last segment about as long as the penultimate and without a terminal stylet, segments twelve to fourteen distinctly binodose. *Thorax* dark brown with black hairs, the anterior lateral angles sometimes of a pale brown colour. Scutellum dark brown with four centro-marginal bristles, two lateral bristles, and two small hairs. Postscutellum and pleurae dark brown. *Wings* sparsely clothed with decumbent hairs which extend basally between the fourth and fifth veins beyond the anterior cross vein. In the female the costa terminates near the middle of the anterior border but extends well beyond the bifurcation of the fifth vein, and the first and third veins form distally a somewhat indefinite cell; in the male, the costa ends before the bifurcation of

the fifth vein and the first and third longitudinal veins form a distinct cell. Halteres with tawny-yellow knobs and dark brown stems. *Legs* brown, uniformly coloured; claws with a basal hairy extension, of the female simple, each with a slight sub-central projection, of the male bifid distally, each with a distinct sub-central projection. *Abdomen* dark brown with black hairs. *Spermatheca* (fig. 9, *f*) heavily chitinised, somewhat reniform, the anterior portion ovoid (length 46μ , breadth 49μ), the posterior portion (length 18μ) narrower and sharply curved.

HYPOPYGIUM (fig. 5). *Ninth segment*: tergite broad, slightly tapering posteriorly and bearing a few moderately long hairs dorsally, posterior margin without a central notch and with the lateral finger-like processes small, apical lobe-like processes well

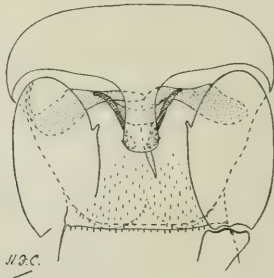


FIG. 5. *D. fusciscutellata*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

developed and with a median triangular dorsal chitinised plate between them; sternite with a somewhat rectangular median posterior projection. *Forceps*: side-pieces strongly chitinised, with long hairs; claspers well chitinised, the basal halves pubescent and bearing one or two relatively stout hairs, the distal extremities slightly depressed. *Harpes*: basal portions strongly chitinised, broad laterally, narrowing towards the middle line; from the left basal portion a feebly chitinised, slightly curved, pointed, blade-like process projects posteriorly as far as the middle of the side-pieces. *Aedoeagus*: median transverse basal portion not very broad, heavily chitinised and slightly twisted and bevelled laterally, lateral portion

strongly chitinated, the distal extremities hook-like and directed dorsally.

HABITAT: Nsawam, Gold Coast. Reared from materials collected from the bases of banana plants, March, 1920.

Dasyhelea similis, sp. n.

MEASUREMENTS.						Female.	Male.
Length of body	...	...	...	...	...	1.1 mm.	1.0 mm.
Length of wing	...	...	...	...	...	0.7 mm.	0.7 mm.
Greatest breadth of wing	...	...	...	...	...	0.3 mm.	0.2 mm.

Head dark brown with dark brown hairs. Eyes narrowly separate in both sexes. Clypeus, proboscis and palpi brown, the third palpal segment slightly but distinctly swollen at the base and attenuated distally, in the female about as long as the fourth and fifth segments together, in the male relatively shorter, about as long as the fifth. *Antennae* brown with brownish-black hairs and, except on the last five segments, long, clear spines; in the female the segments, with the exception of the last, which is the longest but carries no stylet, are all sub-equal in size and ovoid in shape, any one of the apical segments (twelve to fourteen) being, if anything, slightly shorter than any one of the five (seven to eleven) preceding; in the male, segments four to eleven spheroidal gradually becoming narrower and longer towards the apex, the last four segments elongate, twelfth and thirteenth sub-equal, longer than the others, twelfth to fourteenth distinctly binodose. *Thorax* dark brown, the anterior lateral angles sometimes paler brown. Scutellum dark brown with four* centro-marginal and two lateral bristles, and two or more small hairs. Post-scutellum and pleurae dark brown. *Wings* sparsely clothed with decumbent hairs which scarcely extend basally beyond the cross-vein; in the male the costa extends slightly beyond the middle of the wing, its end lying above the fork of the fifth vein, and the first and third veins form a distinct cell; in the female the costa extends beyond the middle of the wing and terminates distally to the fork of the fifth vein, forming with the first and third vein a somewhat indefinite cell. Halteres with pale yellow knobs and dark brown stems. *Legs* uniformly brown. Female claws simple, male claws bifid with a slight indication of a sub-central projection; in both sexes with a hairy extension.

* The two middle centro-marginal bristles may be replaced by a single central bristle in this and other species of *Dasyhelea*.

at the base. *Abdomen* dark brown clothed with dark hairs. spermatheca (fig. 9, *e*) sub-spherical (diameter 46μ), moderately chitinated, the duct scarcely chitinated at its commencement.

HYPOPYGIUM (fig. 6). *Ninth segment*: tergite scarcely tapering posteriorly, the margin straight with rudimentary finger-like processes each bearing two setae, the apical lobe-like processes large; sternite not produced posteriorly. *Forceps*: side-pieces clothed with long hairs, claspers strongly chitinated, the basal halves pubescent, the apical halves bearing one or two short hairs near their distal extremities which are depressed. *Harpes*: basal portions curved, ribbon-like, symmetrical, joined medially, forming a

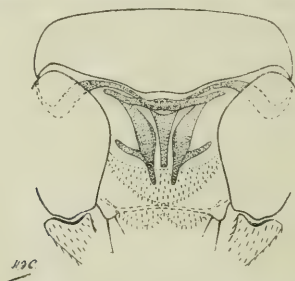


FIG. 6. *D. similis*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

transverse bar from the centre of which a heavily chitinated structure (representing the fused distal portions) extends posteriorly and ends in a rather blunt point. *Aedoeagus*: median transverse basal portion strongly chitinated, narrow, somewhat thickened in the middle (triangular in some views), and but slightly curved, lateral portion terminating in moderately sharp points and bearing dorsally a strongly developed barb which projects transversely and is curved in an anterior direction.

HABITAT: Nsawam, Gold Coast. Reared from rotting material collected from the bases of banana plants, March, 1920.

D. similis closely resembles *D. fusciscutellata* but is of a rather lighter colour, generally with lighter yellow halteres; the species may be readily distinguished by the form of the spermatheca in the females and the structure of the hypopygium in the males.

Dasyhelea luteoscutellata, sp. n.

MEASUREMENTS.						Female.
Length of body (one specimen)	...	...	...	...	...	1.1 mm.
Length of wing	...	...	...	...	...	0.8 mm.
Greatest breadth of wing	...	...	...	...	...	0.3 mm.

Head dark brown with dark hairs. Eyes narrowly separate. Clypeus, proboscis and palpi brown, the third palpal segment longest, slightly swollen basally, the fourth and fifth segments together longer than the third. *Antennae* brown with dark brown hairs and long spines, curved and somewhat hair-like, on segments four to ten, inclusive; the latter segments sub-spherical to ovoid, elongating towards the apex, the terminal five segments distinctly more elongate, together longer than segments three to ten united, the last segment without a stylet. *Thorax* dark brown with dark hairs. Scutellum bright yellow with four centro-marginal and two lateral bristles, and a small central hair. Post-scutellum and pleurae dark brown. *Wings* similar to those of *D. pallidihalter*. Halteres with white knobs and dark brown stems. *Legs* brown, uniformly coloured. Claws simple without a sub-central prominence. *Abdomen* dark brown clothed with dark brown hairs. Spermatheca sub-spherical (diameter 43μ); the duct chitinised for a short distance only.

HABITAT: Nsawam, Gold Coast. Reared from material collected from the base of a banana plant; the pupa and larva were not identified.

This species is a small, dark brown or almost black midge, resembling *D. pallidihalter* but with the scutellum entirely bright yellow, not darkened laterally; the long spines on the basal segments of the antennae are more slender and hair-like than in *D. pallidihalter*.

Dasyhelea inconspicua, sp. n.

MEASUREMENTS.						Female.	Male.
Length of body (two specimens)	...	...	...	...	...	1.0 mm.	1.1 mm.
Length of wing	...	...	...	...	...	0.7 mm.	0.9 mm.
Greatest breadth of wing	...	...	...	...	...	0.4 mm.	0.5 mm.

Head dark brown. Eyes broadly contiguous in the female, narrowly separate in the male. Proboscis and palpi brown, the

latter relatively long, the third segment elongate, cylindrical, as long as the fourth and fifth segments together, the second segment about half the length of the third. *Antennae* brown with dark brown hairs; in the female, segments four and five sub-spherical, six to fifteen oval, gradually becoming longer towards the apex, the last segment broad without a stylet (fig. 2, *b*); in the male, segments four to eleven spheroidal to ovoid, segments twelve to fifteen elongate, the twelfth and thirteenth sub-equal, longer than the fourteenth and fifteenth, the last segment rather shorter than the fourteenth, without a stylet. *Thorax* dark brown with dark hairs. Scutellum yellowish brown with four centro-marginal and two lateral bristles in both sexes, small hairs absent. Post-scutellum and pleurae dark brown. *Wings* densely clothed with decumbent hairs, which in the female extend to the base between the fourth and fifth veins. In the female the costa extends to about the middle of the anterior margin, its extremity distal to the bifurcation of the fifth vein, forming with the first and third veins a narrow, slit-like cell; in the male the costa scarcely reaches the middle of the anterior margin and terminates above the bifurcation of the fifth vein. Halteres with pale brown knobs and dark brown stems. *Legs* brown. Male claws bifid at their extremities and with a minute sub-basal hairy extension on their inner sides; female claws simple, with a sub-basal extension similar to that of the male, but smaller. *Abdomen*: dorsum dark brown with brown hairs, venter paler brown. Spermatheca strongly chitinised, spherical (diameter 32μ), the chitinised portion of the duct straight (length 5μ).

HYPOPYGIUM (fig. 7). *Ninth segment*: tergite scarcely tapering towards its posterior extremity and scantily clothed with long, stout hairs, the finger-like processes moderately small and somewhat pointed, each bearing a relatively long hair near the apex and four near the base, apical lobe-like processes well developed and bearing between them a small triangular chitinised plate (not shown in the figure), sternite prolonged centrally and posteriorly into a long narrow process which covers the aedoeagus and ends in what looks like, but actually is not a strongly chitinised spine. *Forceps*: side-pieces well chitinised, with very long hairs, claspers with the basal halves pubescent and the tips depressed, and bearing a few minute hairs. *Harpes*: basal portions heavily chitinised, broad

laterally and somewhat L-shaped; distal portion of the left harpe developed but small, slender and feebly chitinised. *Aedoeagus*: median transverse proximal portion slightly curved and tapering laterally; lateral portions look as if they were twisted, apparently each composed of two plates, between them a tapering median gutter-like process with a blunt end (not shown in the figure); the junction between the plates on each side is very thinly chitinised.

PUPA: Length (two specimens) 2 mm.; dorsum of the cephalothorax somewhat infuscated anteriorly, the anterior margin and the



FIG. 7. *D. inconspicua*, sp.n., male hypopygium (ventral view), $\times 400$ circa.

posterior end of the abdomen conspicuously shagreened. *Respiratory trumpets*: length about 0.2 mm.; curved, and conspicuously ringed except at the extremities. The main tracheal trunk gives off laterally, at fairly regular intervals, a few processes which open on elevations slightly larger than the ordinary corrugations of the trumpet, and apically about eight short blunt processes arranged in a fan-like manner. *Cephalothorax* without strongly armed tubercles. Anterior marginal tubercles divergent, dark coloured,

and covered with coarse dark spicules bearing a minute terminal hair; between the anterior marginal tubercles are two small dark elevations, one behind the other, covered with coarse dark spicules; anterior dorso-median tubercles triple, each with small setae internally; dorso-lateral tubercles each showing two slightly rounded elevations bearing small delicate hairs. Dorsal tubercles represented by a few minute hairs, and on each side of the middle line are three dark puckered macules, forming an irregular row across the dorsum; in front of this row on each side are three similar, if less distinct, macules. *Abdomen*: the arrangement of tubercles and form of the terminal processes are similar to those of the preceding species.

LARVA. Length 2·6 mm., greatest breadth 0·2 mm. (two specimens, apparently not quite mature). *Head*: length about 0·2 mm., greatest breadth 0·14 mm.; well chitinated, conical. Mental plate resembling that of *D. pallidihalter*, but apparently with five rather large coarse teeth on each side instead of eight.

HABITAT: Oblogo; reared from pupae found in collections of water in the bottoms of canoes tied to the bank of the river Densu, also from rotten wood taken from the sides and ends of the same canoes; December, 1919, to March, 1920. Also larvae, pupae and adults in the collection of the Liverpool School of Tropical Medicine obtained from the rotting vegetation at the sides of a water hole at Christiansborg, Accra, March, 1918.

Dasyhelea nigricans, sp. n.

MEASUREMENTS.

								Male.
Length of body	...	...	...	...	...	...	...	1·3 mm.
Length of wing	...	...	...	...	...	...	...	1·0 mm.
Greatest breadth of wing	...	...	...	...	...	...	...	0·3 mm.

Head very dark brown, almost black. Eyes narrowly separated. Clypeus and proboscis dark brown. Palpi brown with dark hairs, third segment the longest, but not so long as the fourth and fifth together and not appreciably swollen, the last segment distinctly longer than the fourth. *Antennae* very dark brown with a plume of black hairs. Segments four to eleven spheroidal, the last four segments more elongate, sub-equal in length, without long spines, the last slightly shorter than the penultimate and without a stylet; segments twelve to fourteen distinctly binodose.

Thorax dark brown, almost black, with small yellowish-brown patches at the anterior lateral angles and over the bases of the wings. Scutellum orange brown in the middle, dark brown at the sides, bearing four centro-marginal and two lateral bristles, and one or two median short hairs. Post-scutellum and pleurae dark brown. *Wings* sparsely clothed with decumbent hairs. The costa terminates about the middle of the wing and proximal to the bifurcation of the fifth vein; the first and third veins form distally a single small cell. Halteres with yellowish-brown knobs and dark brown stems. *Legs* brown, almost uniformly coloured, the femora and two terminal tarsal segments slightly darker. Claws bifid distally without a sub-basal projection. *Abdomen*: dorsum very dark brown, scantily clothed with black hairs, venter distinctly lighter in colour.

HYPOPYGIUM (fig. 8). *Ninth segment*: tergite long, reaching beyond the ends of the side-pieces, tapering posteriorly and showing



FIG. 8. *D. nigricans*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

a slight concavity at its posterior margin, clothed dorsally with a few moderately long hairs, finger-like processes well developed, dark, each with a rounded apex bearing a small terminal hair; sternite prolonged posteriorly into a cone-like process. *Forceps*: side-pieces prolonged distally on their inner sides into sub-conical, thinly chitinised lobes which are clothed with short, stout hairs—the

inner margin from the base of each side-piece as far as the origin of the lobes is very heavily chitinised; claspers double, the inner piece more heavily chitinised and shorter than the outer, pubescent, ending in a strongly pointed process which carries a relatively stout hair, and showing a secondary barb on its convex margin at about the apical third, the outer portion less heavily chitinised, pubescent on the basal half or two-thirds and of normal form, with the apex depressed and bearing a few small hairs. *Harpes*: basal portions rather broad, strongly chitinised, asymmetrical; from the right basal portion there arises a curved, heavily chitinised, blade-like structure which tapers to a point distally, and is prolonged posteriorly as far as the distal end of the main part of the side-piece; laterally the basal portions are produced into strongly chitinised bars which run diagonally backwards and join the end of the chitinised inner margin of the side-pieces. *Aedoeagus*: strongly chitinised, broad; the median transverse proximal portion with wing-like prolongations, the lateral portions each composed of a dorsal and ventral plate, the extremities divergent, pointed, resembling a pair of shears.

HABITAT: Accra, Gold Coast. Two males taken in the evening upon the windows of the laboratory, January and February, 1920.

Dasyhelea flava, sp. n.

MEASUREMENTS.					Female.	Male.
Length of body (three specimens)	...	...	...	...	1.2 mm.	1.3 mm.
Length of wing	...	...	...	...	0.8 mm.	0.9 mm.
Greatest breadth of wing	...	...	...	...	0.2 mm.	0.3 mm.

Head yellow, the middle of the occiput brown. Eyes separated, narrowly in the female, more widely in the male. Clypeus yellow. Proboscis and palpi brown, the first segment of the palpi very small, the third segment inflated, about one-third longer than the fifth in the female; third segment of palpi in male cylindrical, less inflated than in the female. *Antennae* brown with dark hairs; in the female, segments four to ten bear stout sensory spines and are sub-spherical to oval in shape, the length varying from one to one and one-fifth the width, segments eleven to fourteen slightly longer, the last segment tapering to a narrowly rounded apex and almost one and three-quarter times

the length of the preceding segment; in the male, segments four to eleven oval to sub-oval in shape (almost hexagonal in transverse section), varying in length from two-thirds to one and a half times the width, last four segments gradually decreasing in length, twelve to fourteen, not binodose but exhibiting the usual sculpturing, with a basal whorl of hairs and shorter hairs distally, the last segment longest, longer than the twelfth, basally very broad and tapering to a pointed apex. *Thorax* canary yellow with three broad longitudinal brown bands: a median, which runs from the anterior margin to the posterior third of the dorsum and is frequently divided down its middle by a narrow yellow line, and lateral bands extending from the anterior fourth of the dorsum almost to the scutellum. In the male the thoracic pattern is less conspicuous, the yellow markings being contracted so that the general colour appears brown with yellow markings, rather than yellow with brown markings. Scutellum canary-yellow with four centro-marginal and two lateral black bristles, in both sexes; small hairs absent. Post-scutellum dark brown. Pleurae almost entirely canary yellow with small brown markings. *Wings* hyaline without spots, clothed with decumbent hairs which extend basally well beyond the cross-vein. Halteres canary-yellow in both sexes. *Legs* brown, rather lighter coloured in the male, the knees infuscated. Claws simple, bifid at the tips in the male. *Abdomen*: dorsum dark brown, venter somewhat tawny, especially towards the apices of the segments. Arising from the centre of the anterior margin of the eighth sternite in the female and extending forwards into the seventh segment is a blunt, chitinous and apparently tubular process (fig. 9, *a*); the lower laminae appear to arise from the anterior edge of the eighth sternite, but the upper laminae extend backwards internally almost to the edge of the segment. This structure is conspicuous in specimens which have been treated with caustic potash, but is largely obscured by pigment in carbolic preparations; even in dry specimens, however, a small portion of the lower plate can usually be detected near the middle of the anterior margin of the eighth segment. Spermatheca (fig. 9, *b*), single, moderately chitinated, sub-spherical to oval (44μ by 40μ) in shape with the beginning of the duct chitinated.

HYPOPYGIUM (fig. 10). *Ninth segment*: tergite broad basally, tapering distally, sparsely clothed with strong hairs, posterior margin

not notched and without finger-like lateral processes, sternite relatively narrow, with a conspicuous but not heavily chitinised median pincer-like process projecting backwards ventral to the aedoeagus. *Forceps*: side-pieces short and stout, broader apically than basally, rather scantily clothed with moderately long hairs; claspers bifid, highly chitinised, antler-like, the inner branch pointed and bearing two setae a little beyond the middle, the outer branch strongly curved, pointed, with a prominent seta near the base. *Harpes*: basal portions articulating with the base of the side-pieces,

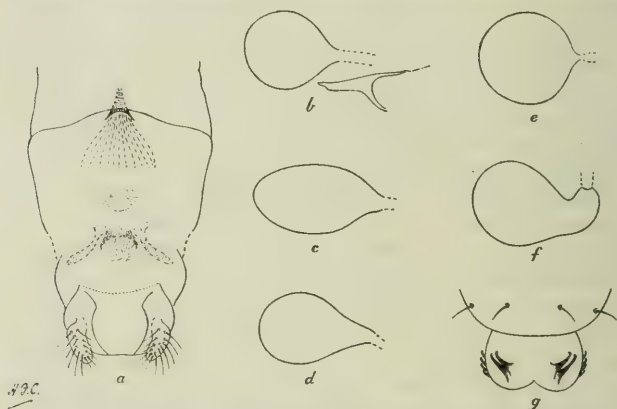


FIG. 9. *a*—Terminal segments of abdomen of female *D. flava*, sp.n. (ventral view) showing the chitinous median process arising from the posterior margin of the eighth segment; *b*—*D. flava*, spermatheca and median process (side view); *c*—*D. fuscipleuris*, spermatheca; *d*—*D. flaviiformis*, spermatheca; *e*—*D. similis*, spermatheca; *f*—*D. fusciscutellata*, spermatheca; *g*—*D. pallidibulser*, posterior extremity of larva showing the small pseudopod. (*a* $\times 123$; *b-f* $\times 360$; *g* $\times 490$.)

strongly chitinised; from the right basal portion arises a lightly chitinised sickle-like process which is very long and tapers gradually towards the tip—it is first directed dorsally, but later curves strongly in a ventral direction and distally is covered with delicate spicules. *Aedoeagus*: a broadly-ending gutter-like structure tapering but slightly from base to apex, the median transverse portion and the lateral portions heavily chitinised.

PUPA. Length (two specimens) 1.7 mm. *Respiratory trumpets* long, narrow and curved, arising from small tubercles; length about

0.2 mm. Distal extremity not infuscated, slightly broadened and without rings, middle portion irregularly ringed, base slightly constricted; lateral openings of the tracheal trunk occur from base to apex, about six being situated near the tip. *Cephalothorax*: anterior marginal tubercles large, conical, heavily shagreened, bearing a very short bristle. In the middle line between the anterior marginal tubercles is an antero-posterior row of three



FIG. 10. *D. flava*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

unarmed somewhat heavily shagreened tubercles, the most anteriorly placed being slightly ventral, the middle one slightly dorsal, to the marginal tubercles. Anterior dorso-median tubercle represented by two or three small hairs; dorso-lateral tubercle somewhat prominent, irregularly shaped and bluntly rounded, bearing a moderately long and a short hair; ventro-lateral tubercle bearing a minute hair; ventro-median tubercle represented by a small hair. The ventral surface also bears small, highly chitinised, unarmed tubercles, one on each side of the middle line near the centre of the cephalic region. *Abdomen* more heavily shagreened than, but otherwise similar to, that of *D. pallidihalter*.

LARVA. Adults of this species were reared from larvae obtained from banana fibre which had been isolated in small tubes; the larval

pelts were not subsequently found, but as no other species of *Dasyhelea* was reared from this particular sample of banana fibre in the course of some weeks' observation, the *Dasyhelea* larvae found therein have been ascribed to *D. flava*.

Length (three specimens) 2·9 mm.; greatest breadth 0·2 mm. *Head*: length 0·18 mm., greatest breadth 0·12 mm. These larvae are almost indistinguishable from those of *D. pallidihalter*, the only apparent difference being in the size and form of the teeth on the mental plate, in *D. flava* larva the most lateral tooth on each side is smaller, while the others are distinctly larger and coarser than in larvae of *D. pallidihalter*.

HABITAT: Nsawam and Dodowah, Gold Coast. Reared from rotting vegetable material collected at the bases and roots of banana plants, January to May, 1920.

Dasyhelea fuscipleuris, sp. n.

MEASUREMENTS.

Length of body (one female)	...	...	...	...	...	1·2 mm.
Length of wing	...	...	...	...	...	1·0 mm.
Greatest breadth of wing	...	...	...	...	...	0·4 mm.

Head brown. Eyes narrowly separate. Proboscis and palpi brown, the fourth and fifth palpal segments short, sub-equal, third segment slightly inflated and rather longer than the fourth or fifth. Antennae brown; segments four to ten inclusive sub-spherical to broadly oval in shape, in length from four-fifths to one and one-quarter times the greatest width, segments eleven to fourteen oval and in length about one and a quarter times the greatest width, the fifteenth slightly longer and about twice as long as wide. *Thorax* yellow, becoming yellowish-brown posteriorly in front of the scutellum, with broad brown or blackish-brown median and lateral bands; the median band, which has a shining appearance in certain lights, is of almost uniform width and extends from the anterior margin to about the middle of the thorax, the lateral bands are broad and rounded anteriorly, gradually narrowing posteriorly, and extend from the anterior fourth of the thorax almost to the scutellum; each lateral band near the middle of its outer border gives off a narrow dark stripe which is directed forwards and ends a short distance behind the antero-lateral angle. Scutellum entirely pale

yellowish-brown with three or four centro-marginal and two lateral bristles; short hairs absent. Post-scutellum dark brown. Pleurae almost entirely yellowish-brown with a few small darker brown markings. *Wings* hyaline, sparsely clothed with decumbent hairs which scarcely extend basally beyond the cross-vein and in the anterior apical portion are almost confined to the margin and to the fold above the upper branch of the fourth vein. The costa extends slightly beyond the middle of the wing and distinctly beyond the bifurcation of the fifth vein; the single cell between the first and third veins distinct, rather longer than broad. Halteres yellow-brown. *Legs*: distinctly light brown with the extreme bases of all the tibiae and the apices of the hind tibiae very dark brown; the fifth tarsal segments of all the legs are somewhat infuscated. Claws simple. *Abdomen*: dorsum dark brown, with the hind margins of the segments narrowly but distinctly yellowish; venter of a rather pale brown colour. Spermatheca (fig. 9, *c*) single, oval to pyriform (average about 61μ by 42μ), highly chitinated, the commencement of the duct chitinated for a short distance (about 8μ).

HABITAT: Accra, Gold Coast. Two females taken on the arm, one in a bungalow near a light at 9 p.m., April 18th, 1920, and the other in the laboratory in May, 1920. Numerous specimens (\varnothing \varnothing) bred later.

A yellowish-brown midge somewhat resembling *D. flava* in appearance, though less brightly coloured.

Dasyhelea flaviformis, sp. n.

MEASUREMENTS.						Female.	Male.
Length of body	...	...	...	...	...	1.0 mm.	1.0 mm.
Length of wing	...	...	...	...	...	0.6 mm.	0.7 mm.
Greatest breadth of wing	...	...	...	...	...	0.2 mm.	0.2 mm.

Head brown with lighter brown borders round the eyes and occiput. Eyes narrowly separate. Proboscis and palpi brown, third segment of the palpi not swollen, longer than the fourth and about as long as the fifth segment. *Antennae* brown with dark brown hairs; segments four to ten in the female with curved spines, sub-spherical, as broad as long, segments eleven to fourteen rather longer than broad, the terminal segment the longest, being two and a half times as long as broad and almost twice as long as the

preceding segment; the last four segments of the male elongate, segments twelve to fourteen binodose. *Thorax* tawny-yellow with broad, longitudinal, brown bands arranged in much the same pattern as those of *D. flava* and of *D. fuscipleuris*: a broad median band, divided by a narrow, median tawny stripe extends almost from the anterior margin to the posterior third of the dorsum, and lateral bands, one on either side, extend from the anterior third of the dorsum almost to the scutellum. Scutellum tawny-brown with slightly darker brown sides, carrying three central and two lateral bristles in both sexes; short hairs absent. Post-scutellum dark brown. Pleurae tawny with two or three dark brown markings. *Wings* hyaline; decumbent hairs rather more scanty than in *D. flava*, extending basally between the fourth and fifth longitudinal veins to about the point of separation of the first and third longitudinal veins, the anal cell bare and the anterior apical region rather more sparsely clad. Halteres with brown stems and cream-coloured knobs. *Legs*

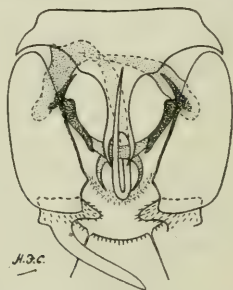


FIG. 11. *D. flaviformis*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

almost uniformly light brown, with dark knee spots. Claws simple and equal. *Abdomen* dark brown; in the female there are semi-lunar tawny markings on either side of the middle line on the dorsum of the fifth, sixth and seventh segments, and the apex of the abdomen is pale; in the male entirely dark, except for small paler lateral spots on the first and second segments. Spermatheca (fig. 9, *d*) pyriform (length 43μ , breadth 35μ), moderately highly chitinised, the commencement of the duct chitinised.

HYPOPYGIUM (fig. 11) resembling that of *D. flava*. *Ninth segment*: tergite broad basally, narrowing slightly towards the

apical margin which is not notched, finger-like lateral processes rudimentary but bearing a single rather long stout hair; sternite with the median, pincer-like extension well developed. *Forceps*: side-pieces relatively longer than in *D. flava*, claspers more slender and less curved, and bearing a rudimentary, conical, second branch on their inner sides basally, the basal portion only pubescent. *Harpes* similar to those of *D. flava* but relatively larger and stouter; the sickle-like structure arising from the right basal process is very long and strongly curved, and apically is devoid of spicules. *Aedoeagus* differs from that of *D. flava* in that the distal extremity gives off two curved chitinous processes, one on either side of the middle line, resembling a pair of forceps.

PUPA. Length about 1.5 mm.; somewhat infuscated at the anterior end, integument shagreened. *Respiratory trumpets* (fig. 3, b): length about 0.15 mm.; breadth about 15 μ . They are infuscated apically, and are long, narrow and curved, arising from slight papillae; the main tracheal trunk begins to give off lateral branches just above its base, the first four widely separate but those near the tip more closely situated, together forming a series of nine or ten branches. The trumpets are irregularly ringed in the middle and show no definite tubercles. *Cephalothorax* infuscated anteriorly; operculum dark, highly chitinised and coarsely shagreened, with two low and rounded, but relatively large, elevations in the middle line. Anterior marginal tubercle well-developed, conical, bearing a very small seta; dorso-lateral tubercles well-developed, bearing several minute hairs; anterior dorso-median tubercle almost indistinguishable, being represented by a few minute hairs; ventral tubercles undeveloped, represented by minute hairs. Dorsum of thoracic region infuscated, without tubercles but with numerous macules. *Abdomen* exhibiting no peculiarities, of the usual pattern but rather poorly chitinised.

HABITAT: Oblogo, Gold Coast. Reared from rotten wood taken from a canoe in the river Densu, May, 1920. The pelt of a larva which had been isolated in a tube with a piece of the rotten wood in which it was found and from which a pupal pelt and an adult of this species were obtained, was not recovered.

A small brown midge resembling in markings *D. flava*, but with the lighter coloured areas a dull tawny-yellow in place of brilliant canary-yellow.

Dasyhelea fusca, sp. n.

MEASUREMENTS.						Female.	Male.
Length of body	...	...	...	...	...	1.5 mm.	1.6 mm.
Length of wing	...	...	...	...	...	1.1 mm.	1.3 mm.
Greatest breadth of wing	...	...	...	...	...	0.4 mm.	0.3 mm.

Head brown with brown hairs. Eyes broadly contiguous in the female, narrowly separate in the male. Proboscis pale brown. Palpi brown, third segment slightly swollen, distinctly shorter than the fourth and fifth segments together. *Antennae* in the female brown, torus much darker than the segments of the flagellum, with dark hairs and large, curved spines (in addition to short blunt spines) on all the segments; segments four to eleven sub-spherical to oval, constricted apically, the last segment elongate, at least one and a half times as long as the penultimate, with a distinct stylet. In the male, strongly plumose, the whorl hairs dark brown; segments three to eleven spheroidal, segments twelve to fourteen elongate, strongly binodose; last segment stout and cylindrical, with a conspicuous stylet. *Thorax* dark brown with paler brown to yellowish areas at the anterior lateral angles and bases of the wings (in fresh specimens the dorsum is greyish-pruinose), sparsely clothed with dark brown hairs. Scutellum pale yellowish-brown with five or six centro-marginal and two lateral bristles, and about six (four to seven) short median hairs. Post-scutellum and pleurae dark brown. *Wings* almost unicolourous but slightly infuscated at the junction of the first and third veins and costa; surface rather thickly clothed with long hairs, which extend basally beyond the cross-vein. First and third veins fused, extending for a considerable distance parallel to the costa and joining the latter well beyond the middle of the anterior border and the bifurcation of the fifth vein. Halteres with cream-coloured knobs. *Legs* light brown, the knees slightly darker, the apices of the tarsal segments infuscated, fore and hind femora each with a dark spot above the apex. Claws simple, bifid distally in the male. *Abdomen* dark brown with brown hairs, which are most numerous at the sides and on the distal segments. Spermatheca more or less pyriform (length 61μ , breadth 45μ) in shape and feebly chitinised.

HYPOPYGIUM (fig. 12). *Ninth segment*: tergite with moderately long hairs dorsally, broad, gradually tapering towards the posterior

margin, the finger-like processes well developed, dark, each with a stout hair at the apex and a group of five or six shorter hairs at the base; sternite relatively broad, without a central posterior projection.

Forceps: side-pieces short and broad, clothed with short, stout hairs; claspers pubescent, rather longer than the side-pieces, the tips slightly rounded and bearing a few minute hairs. *Harpes*: basal portions somewhat asymmetrical, large, strongly chitinised, curving forwards towards their junction near the middle line; distal portion

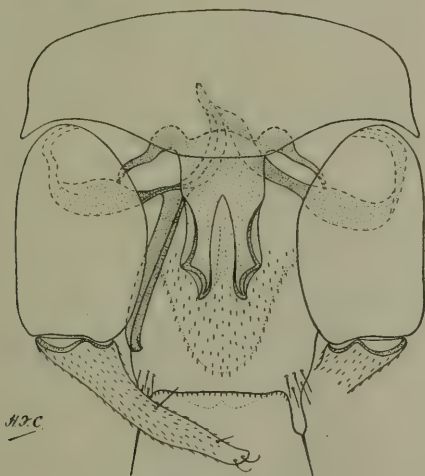


FIG. 12. *D. fusca*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

of the right harpe in the form of a stout, strongly chitinised, blade-like structure with a pointed, slightly re-curved apex, extending posteriorly almost as far as the posterior margin of the ninth tergite. *Aedoeagus* large, projecting posteriorly to about the level of the middle of the side-pieces, broad basally, narrowing slightly apically as shown in fig. 12.

PUPA. Length 2.3 mm.; relatively large and well chitinised, with the cephalo-thoracic portion slightly infuscated and with

characteristic, loofah-like, trumpets. Integument shagreened, especially over the middle of the anterior part of the cephalothorax and on the last abdominal segment. *Respiratory trumpets* (fig. 3, d): length about 0.3 mm., broad and flat, arising from small tubercles; the basal third cylindrical, dark coloured, annulated, the apical two-thirds expanded and flattened, with very numerous tracheal branches arranged somewhat like the leaflets of a long pinnate leaf which has been doubled upon itself so that the fold is at the distal end and the base and tip at the proximal end—the branches are apparently double processes arising from the main tracheal trunk. *Cephalothorax*: anterior marginal tubercles prominent, conical, divergent, covered with coarse dark granulations and ending each in a double-pointed process bearing a delicate hair; anterior dorso-median tubercles somewhat irregularly shaped and bearing small and delicate setae on their inner sides; dorso-lateral tubercles highly granular, bearing one small and one minute seta. On each side of the anterior marginal tubercles is a dark, conical, coarsely granulated nodule, and immediately dorsal to this a smaller and flatter granulated nodule. Dorsal tubercles apparently represented by socket-like marks (which may be surrounded by a dark zone and may show centrally minute points resembling small spines) and by small dark puckered macules—there are about eighteen of the latter, of which fourteen (seven on each side of the middle line) are arranged in an irregular transverse row extending across the dorsum a short distance posterior to the trumpets, and the others are situated anteriorly two on each side of the middle line. Large dark areas, which appear to be slightly raised, also occur over the bases of the wing sheaths and on that part of the cephalothorax immediately posterior to them, and other macules may be distinguished on the posterior portion of the dorsum. *Abdomen*: tubercles poorly developed; on both surfaces of each segment, but more conspicuous on the dorsum, are three rounded and darkened macules arranged in the form of an equilateral triangle with its apex posteriorly directed.

HABITAT: Oblogo, near Accra. Pupae and pupal pelts were found in stagnant water contained in canoes which were tied to the bank of the river Densu; and pupae in the rotten wood forming the sides and ends of these canoes. Larvae were not obtained.

Dasyhelca nigrofusca, sp. n.

MEASUREMENTS.

Male.

Length of body	...	...	...	...	...	...	...	1.5 mm.
Length of wing	...	...	...	...	...	...	...	1.0 mm.
Greatest breadth of wing	...	...	...	...	...	...	...	0.3 mm.

Head dark brown, almost black. Eyes broadly contiguous dorsally. Proboscis and palpi dark brown, the third segment of the palp distinctly swollen and rather longer than the fourth or fifth, which are sub-equal in length. *Antennae* dark brown with almost black hairs; segments four to eleven more or less hexagonal, in length from three-fourths to rather more than once the width, segments twelve to fourteen elongate, binodose, decreasing in length from about three times to two and a half times the width, terminal segment broad, rather shorter than the twelfth segment and with a small apical stylet. *Thorax* dark greyish-pruinose with sepia markings, the lateral margins narrowly yellowish; scantily clothed with dark hairs. Scutellum dark brown in the middle, yellow laterally, with a row of eight sub-marginal bristles and about half a dozen median short hairs. Post-scutellum dark brown. Pleurae yellow with dark brown markings. *Wings* hyaline, well clothed with decumbent hairs. First and third veins apparently completely fused, the bifurcation of the fifth vein lying immediately below the apex of the costa. Halteres brown with paler coloured but slightly infuscated knobs. *Legs* conspicuously banded, femora dark, slightly paler basally and with a distinct pale band before the apex, knee joints dark, tibiae with dark bands at the base, middle and apex, tarsal segments paler, with indications of dark bands at the apices; clothed with dark hairs. Claws simple and equal, bifid at the tips. *Abdomen* sepia-coloured, clothed with dark brown hairs; venter yellowish.

HYPOPYGIUM (fig. 13). *Ninth segment*: tergite scarcely tapering, the posterior margin straight, the finger-like processes well developed, each bearing a single hair and with a prolongation of the tergite connected with them dorsally; sternite without a central posterior extension. *Forceps*: side-pieces of the usual form; claspers as long as the side-pieces, the basal halves pubescent and carrying two short hairs near the middle and three or four short hairs near the apex. *Harpes*: basal portions strongly

chitinised and bent in an anterior direction, that of the right side being shorter and more abruptly bent and articulating with a double curved, blade-like distal process; the latter is very long and reaches posteriorly as far as the apices of the side-pieces, it is broader in the middle than at either extremity, and is serrated at the apex. *Aedoeagus* broad basally, narrowing somewhat apically, the distal portion consisting of two highly chitinised hook-like rods on either side connected by a ventral wall of thin chitin; these lateral rods are not on the same plane, and the ventral pair are longer, less sharply bent medially, and notched at the ends.

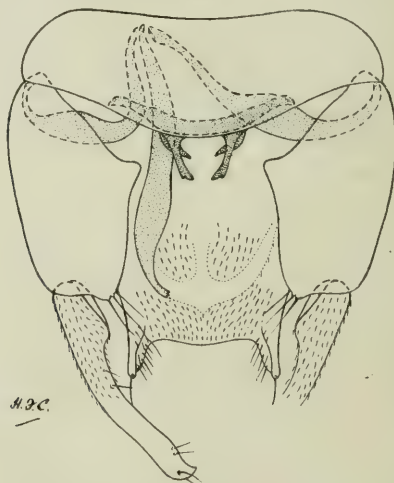


FIG. 13. *D. nigrofusca*, sp.n., male hypopygium (ventral view). $\times 400$ circa.

PUPA. Length 2.6 mm.; shagreened but not highly chitinised. *Respiratory trumpets* (fig. 3, c): length about 0.1 mm., short, broad and constricted at the base, arising from small tubercles and with the basal half covered with minute squamose spines; lateral processes (numbering about twenty) of the tracheal trunk given off at regular intervals—at first in a single, later in a double row, extending from a short distance above the base to the apex. *Cephalothorax*: spines and tubercles poorly developed; operculum

wanting. Anterior marginal tubercle small, bearing a small bristle; dorso-lateral tubercle bearing two small hairs; anterior dorso-median tubercle very small with two hairs; ventro-median tubercle minute, bearing a small hair; ventro-lateral tubercle represented by two or three small hairs. Dorsum of the thoracic portion without tubercles or spines. *Abdomen*: integument with transverse cellular sculpturing and minute spicules basally and laterally; these spicules are most numerous and most highly developed on the last segment and its terminal processes. The segments are furnished with the usual backwardly projecting shelf-like tubercles, those forming the ventro-lateral series being the most prominent.

HABITAT: Dodowah, Gold Coast (north-east of Accra), reared from materials collected from a rot-hole in a mango tree, March 7th, 1920. The larva was not identified.

Dasyhelea fusciformis, sp. n.

MEASUREMENTS.								Female.
Length of body	...	...	...	...	...	...	...	1.3 mm.
Length of wing	...	...	...	...	...	...	...	1.1 mm.
Greatest breadth of wing	...	...	...	...	...	...	...	0.3 mm.

Head brown with brown hairs. Eyes very narrowly separate, almost contiguous. Clypeus, proboscis and palpi brown; all segments of the latter somewhat swollen, the third cylindrical, longer than the fourth and fifth segments together, the fifth much shorter than the fourth. *Antennae* brown with brown hairs and long curved spines on all the segments; segments of the flagellum sub-spherical to oval in shape, each with an apical constriction, the last segment elongate with a distinct stylet (fig. 2, a). *Thorax* dark brown with dark hairs, the anterior-lateral angles and areas at the bases of the wings paler brown. Scutellum light brown with eight centro-marginal and two lateral bristles, and three short hairs. Post-scutellum and pleurae dark brown. *Wings*: decumbent hairs extending to the base of the wing between the fourth and fifth veins; costa reaching the middle of the anterior border and terminating beyond the bifurcation of the fifth vein, the first and third veins distally forming a small cell. Halteres with cream-coloured knobs and dark brown stems. *Legs* uniformly brown, the claws simple. *Abdomen* dark brown, lighter coloured distally, with dark brown hairs.

Spermatheca sub-spherical (length 53μ , width 48μ), moderately chitinated, the duct wide at its origin, tapering gradually and chitinated for a very considerable portion (50μ) of its length.

PUPA. Length 2 mm., moderately well chitinated, the integument shagreened and the last abdominal segment with small spicules. *Respiratory trumpets*: length about 0.17 mm., breadth 0.03 mm., rather short, broad and almost straight, with a slight basal constriction and with the surface covered with minute, imbricated, flattened spines. The tracheal trunk gives off three or four lateral branches at regular intervals in the basal three-fourths of the trumpet, and a series of about a dozen close together in the apical fourth. *Cephalothorax*: anterior marginal tubercles wanting—the operculum missing from the single pelt examined; anterior dorso-median tubercle poorly developed, bearing a single small hair; dorso-lateral tubercle small, carrying two short hairs; ventro-lateral tubercle indistinguishable; ventro-median tubercle represented by two small hairs. Integument of the dorsum of the thoracic portion with puckered macules, but without tubercles. *Abdomen* with tubercles of the usual type and arrangement.

The pupal stage is apparently short, as the adult insect appeared on the fourth day after isolating the larva. The pupal pelt was found with the cephalothorax protruding from a piece of rotten wood.

LARVA. A single larva of this species was collected and isolated in a small tube; it was rather large, with well-formed hooks at the posterior end of the abdomen. Its movements were slow and deliberate and it was observed to crawl up the sides of the glass vessel in which it was contained, but afterwards it quickly buried itself in the rotten wood and was not seen again. After the insect had hatched the pupal pelt was secured, but the only portion of the larval pelt found was the head; this was dark-coloured and heavily chitinated, and measured 0.3 mm. in length and 0.2 mm. in greatest width.

HABITAT: Oblogo, Gold Coast. Reared from materials collected from a rot-hole in a tree (*Cynometra* sp., probably *C. megalophylla*, Harms.), May, 1920.

D. fusciformis is a brown midge closely resembling *D. fusca*, but smaller in size and with the colouring of the scutellum and the lighter

patches on the thorax pale brown rather than yellow. The spermathecae and pupae of these two species are quite distinct.

The species of *Dasyhelca* described above may be separated as follows:—

FEMALES

1. Antennal segments sub-spherical or oval, not constricted apically, the last segment not produced into a stylet; scutellum with at most four centro-marginal bristles 2
 Antennal segments constricted apically, the last with a distinct stylet; scutellum with at least five centro-marginal bristles ... 9
2. Species mainly dark brown in colour 3
 Species yellowish with dark brown markings 7
3. Scutellum dark brown, at most with the central portion yellowish... 4
 Scutellum entirely yellowish 6
4. Scutellum yellowish in the middle; halteres white, *pallidihalter*, sp. n. (p. 184)
 Scutellum entirely dark brown; halteres yellowish 5
5. Spermatheca reniform; claws with a distinct sub-central projection *fusciscutellata*, sp. n. (p. 187)
 Spermatheca spherical; claws without a distinct sub-central projection *similis*, sp. n. (p. 189)
6. Scutellum bright yellow; halteres white ... *luteoscutellata*, sp. n. (p. 191)
 Scutellum yellowish-brown; halteres yellowish-brown
 *inconspicua*, sp. n. (p. 191)
7. Species bright yellow; the eighth abdominal segment with a ventral backwardly directed chitinous process *flava*, sp. n. (p. 196)
 Species dull yellow; the eighth abdominal segment without such a process 8
8. Larger species (wing length 1.0 mm.); halteres yellowish-brown; hind margins of abdominal segments narrowly yellowish ...
 *fuscipleuris*, sp. n. (p. 200)
 Smaller species (wing length 0.7 mm.); halteres cream-coloured; semilunar tawny markings on dorsum of fifth, sixth, and seventh abdominal segments *flaviformis*, sp. n. (p. 201)
9. Spermatheca pyriform, feebly chitinised; scutellum with five or six centro-marginal bristles *fusca*, sp. n. (p. 204)
 Spermatheca spherical, moderately chitinised, with a very long posterior extension; scutellum with eight centro-marginal bristles *fusciformis*, sp. n. (p. 209)

MALES (separation on hypopygial characters)

- | | | | | | | | | |
|--|-----|-----|-----|-----|-----|-----|-----|--|
| 1. Claspers single | ... | ... | ... | ... | ... | ... | ... | 2 |
| Claspers double | ... | ... | ... | ... | ... | ... | ... | 6 |
| 2. Ninth sternite with a central posterior extension | ... | ... | ... | ... | ... | ... | ... | 3 |
| Ninth sternite without a central posterior extension | ... | ... | ... | ... | ... | ... | ... | 4 |
| 3. Posterior extension of ninth sternite large, ob-ovate | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>pallidibalter</i> , sp. n. (p. 184) |
| Posterior extension of ninth sternite smaller, somewhat rectangular | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>fusciscutellata</i> , sp. n. (p. 187) |
| Posterior extension of ninth sternite cone-like | ... | ... | ... | ... | ... | ... | ... | <i>inconspicua</i> , sp. n. (p. 191) |
| 4. Distal portions of harpes fused, forming a single median process | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>similis</i> , sp. n. (p. 189) |
| Distal portion of one harpe only developed | ... | ... | ... | ... | ... | ... | ... | 5 |
| 5. Aedoeagus relatively short, reaching about one-third the length of the side pieces; distal fourth of the harpal process attenuated, the apex serrated | ... | ... | ... | ... | ... | ... | ... | <i>nigrofusca</i> , sp. n. (p. 207) |
| Aedoeagus long, reaching beyond the middle of the side pieces; harpal process not attenuated distally, the apex pointed | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>fusca</i> , sp. n. (p. 204) |
| 6. Inner portion of clasper small, conical | ... | ... | ... | ... | ... | ... | ... | <i>flaviformis</i> , sp. n. (p. 201) |
| Both portions of clasper large and well developed | ... | ... | ... | ... | ... | ... | ... | 7 |
| 7. Central posterior extension of the ninth sternite cone-like | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>nigricans</i> , sp. n. (p. 194) |
| Central posterior extension of the ninth sternite pincer-like | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | <i>flava</i> , sp. n. (p. 196) |

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